FIG. 1

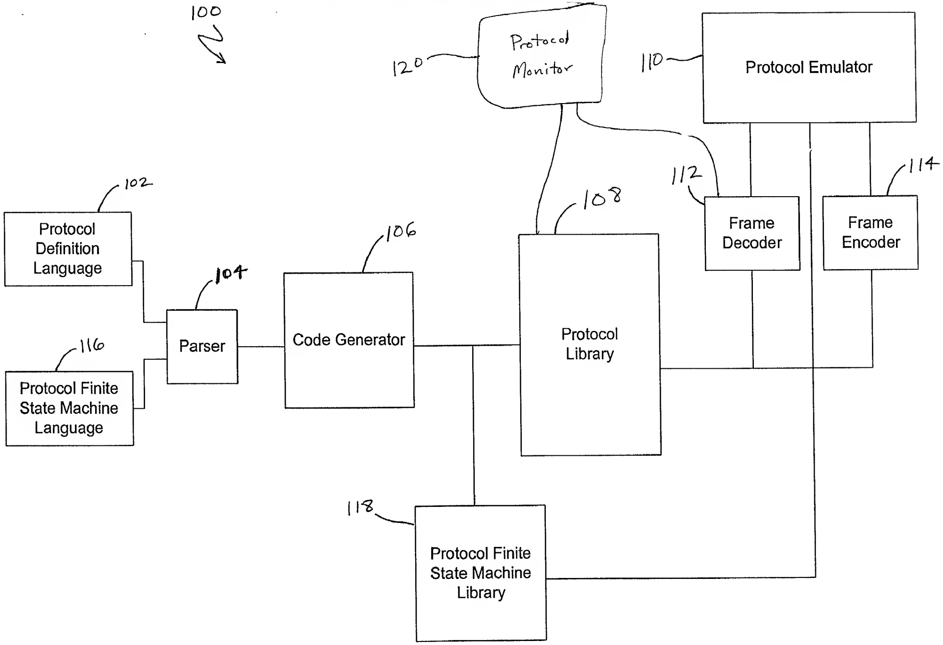

100
Protocol Monitor
120
110
Protocol Emulator
102
Protocol Definition Language
112
114
108
Frame Decoder
Frame Encoder
106
104
Parser
Code Generator
Protocol Library
116
Protocol Finite State Machine Language
118
Protocol Finite State Machine Library

FIG. 2 (prior art)

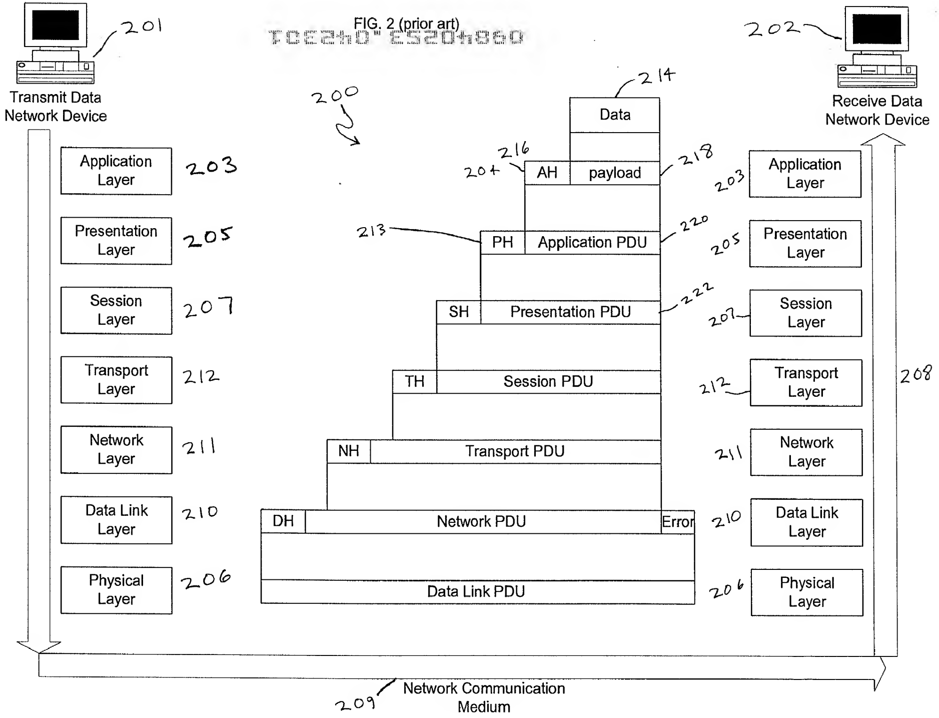


FIG. 3 (prior art)

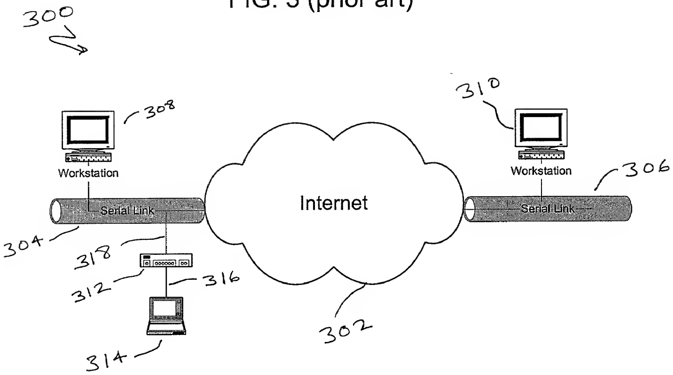


FIG. 4 (prior art)

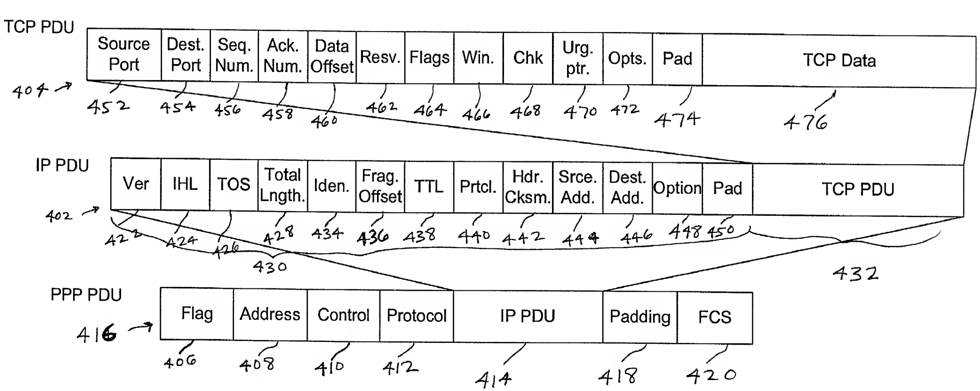


FIG. 5

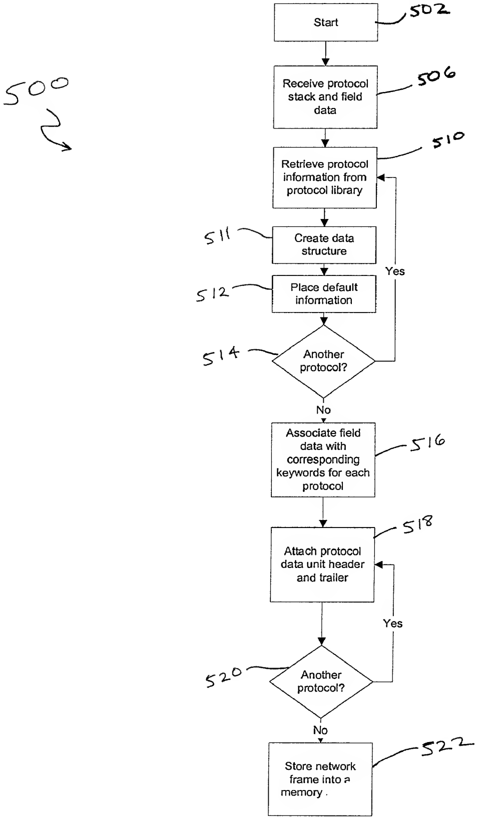

500
Start
502
Receive protocol stack and field data
506
Retrieve protocol information from protocol library
510
Create data structure
511
Place default information
512
Another protocol?
514
Yes
No
Associate field data with corresponding keywords for each protocol
516
Attach protocol data unit header and trailer
518
Another protocol?
520
Yes
No
Store network frame into a memory .
522

FIG. 6

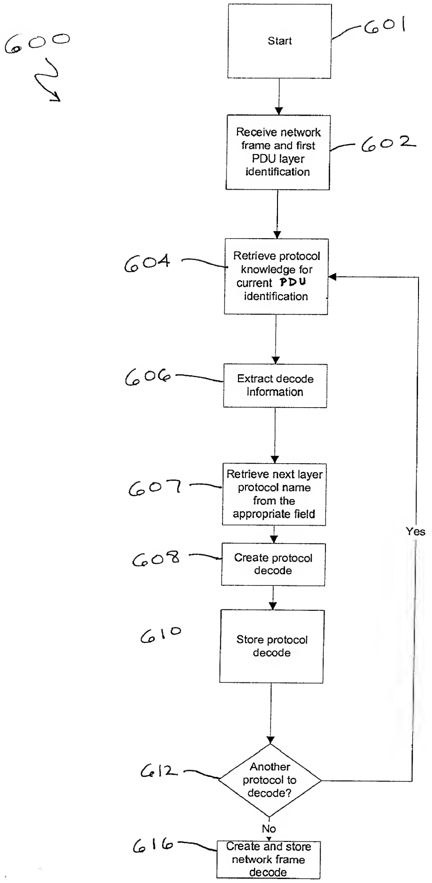

600
Start
601
Receive network frame and first PDU layer identification
602
604
Retrieve protocol knowledge for current PDU identification
606
Extract decode information
607
Retrieve next layer protocol name from the appropriate field
608
Create protocol decode
610
Store protocol decode
612
Another protocol to decode?
Yes
No
616
Create and store network frame decode

FIG. 7

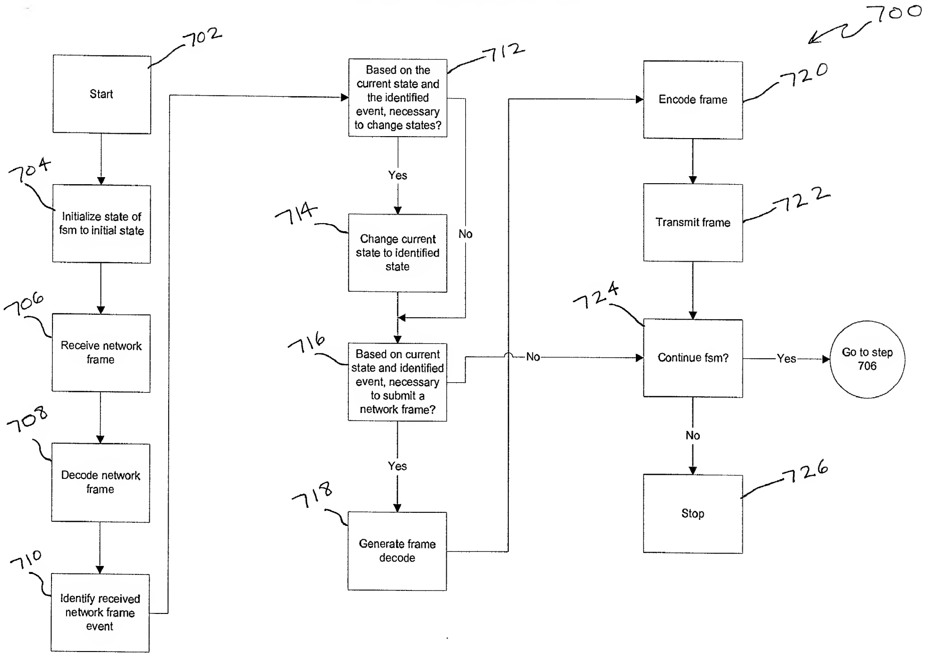

700
702
Start
704
Initialize state of fsm to initial state
706
Receive network frame
708
Decode network frame
710
Identify received network frame event
712
Based on the current state and the identified event, necessary to change states?
Yes
No
714
Change current state to identified state
716
Based on current state and identified event, necessary to submit a network frame?
Yes
No
718
Generate frame decode
720
Encode frame
722
Transmit frame
724
Continue fsm?
Yes
Go to step 706
No
726
Stop

FIG. 8A

```
    protocol "IP" {//-----------------------------------------------------------
802       len=valueof(field "Total Length")*8
804       minLen=20*8  //just header
          maxLen=65535*8
        header "IP Header"
806       payload "IP Payload"
808

      header "IP Header"   {//-----------------------------------------------

810  812  len=valueof(field "Header Length")*32
     816  field "Version"
     818  field "Header Length"
     814  compound_field "Type Of Service"
     824  field "Total Length"

820 field "Identification" {len=16 default=291}
815 compound_field "Flags"
822 field "Fragment Offset" {len=13  desc="in 64 bits units"}
826 field "Time To Live" {len=8 default=30 desc="seconds"}
828 field "Protocol"
830 field "Header Checksum"
832 field "Source IP Address" {len=32 display=ipv4  field_type=must_encode}
834 field "Destination IP Address" {
                  len=32
                  display=ipv4
                  field_type=must_encode
          }

816 repeat {
              len = (valueof (field "header Length") - 5 )*32 // includes padding
        compound_field "Options"
      }


        field "Version" {
                  len=4
                  default=4
                  possible_values={
          0,15:"Reserved"
          1-3: "Unassigned"
                    6-14:"Unassigned"
          4:"IP Internet Protocol"
          5:"ST ST Datagram Mode"
        }}
```

FIG. 8B

```
field "Header Length" {
        len=4
        minValue=5
        desc="in 32 bit units"
        default=eval_fn(len, "IP", "IP Header", "/32")
}

field "Total Length" {
        minValue=20
        len=16
        desc="in octets include header length"
        default=eval_fn(len, "IP", "IP", "/8")
}


  field "Header Checksum" {
        len=16
        default=eval_fn(checksum, "IP", "IP Header")
        display=hex
}

compound_field "Type Of Service" { //---------------------------------
        display=hex
        field "precedence" {
        len=3
        possible_values={
0:"Routine"
1:"Priority"
2:"Immediate"
3:"Flash"
4:"Flash override"
5:"CRITIC/ECP"
6:"Internetwork Control"
7:"Network Control"
}}

field "Delay" {
len=1
        possible_values={0:"normal" 1:"low"}}

field "Throughput"   {
        len=1
possible_values={0:"normal" 1:"high"}}

field "Reliability" {
        len=1
```

FIG. 8C

```
        possiblc_valucs={0:"Normal" 1:"High"}}

        field "Monetary Cost" {
                len=1
        possible_value={0:"normal" 1:"low"}}


        field "Unused" {
                len=1
                possible_values={0:"Valid"}}

        }// end of field "type of service" -------------------------------------

        compound_field "Flags" {

                len=3
                display=hex
        field "Reserved" {
                        len=1
                        possible_values={0:"Valid"}}

            field "Fragment" {
                        len=1
                        possible_values={0:"May Fragment" 1:"Don't Fragment"}}
            field "Fragments" {
                        len=1
                        possible_values={0:"Last" 1:"More"}}
        }


compound_field "Options" {//-----------------------------------------------

    optional = (valueof (field "Header Length") > 5)
    compound_field "Option Tuple"
    {
     len = 8;
     display=hex
     field "Copied Flag" {
                len=1
                possible_values={
             0:"not copied into all fragments on fragmentation"
       1:"copied into all fragments on fragmentation"
    }}

    field "Option Class" {
                len=2
```

FIG. 8D

```
                possible_values={
                0:"control"
        1:"reserved for future use"
                2:"debugging and measurement"
                3:"reserved for future use"
}}

field "Option Number" {
                len = 5
                field_type = mulopt_other_fld
                possible_values={
              0:"End of Option list"
          1:"No Operation"
              2:"Security"
              3:"Loose Source Routing"
          4:"Internet Timestamp"
              7:"Record Route"
          8:"Stream ID"
              9:"Strict Source Routing"
}}
}

switch(valueof(field "Option Number")){
  0:null
  1:null
  2:compound_field "Security"
  3:compound_field "Loose Source Routing"
  9:compound_field "Strict Source Routing"
  7:compound_field "Record Route"
  8:compound_field "Stream ID"
  4:compound_field "Internet Timestamp"
}


compound_field "Security"{
            len=80
            field "Security length" {
                    len=8
                    possible_values={0x0b:"Valid"}}
            field "Security: Security"
            field "Compartments" {len=16}
            field "Handling Restrictions" {len=16}
            field "Transmission Control Code" {len=24}


            field "Security Security" {
```

FIG. 8E

```
            len=16
            possible_values={
            0:"Unclassified"
            0xf135:"Confidential"
            0x789a:" EFTO"
            0xbc4d:"MMMM"
            0x5e26:"PROG"
            0xaf13:"Restricted"
            0xd788:"Secret"
            0x6bc5:"Top Secret"
            0x35e2,0x9af1,0x4d78,0x24bd,0x135e,0x89af,0xc4d6,0xe26b:
      "Reserved for future use"
  }}
}

compound_field "Strict Source Routing" {
  len = (valueof(field "Strict Source Routing Length")-1)*8
  field "Strict Source Routing Length" {len=8 }
  field "Strict Source Routing Pointer" {len=8 minValue=4}

  repeat {
    len = (valueof(field "Strict Source Routing length")-3)*8
    field "source address" {len=32  display=ipv4}
  }
}

compound_field "Loose Source Routing"  {
  len = (valueof(field "Loose Source Routing length")-1)*8
  field "Loose Source Routing length" {len=8 }
  field "Loose Source Routing pointer" {len=8 minValue=4}
  repeat {
    len = (valueof(field "Loose Source Routing length")-3)*8
    field "source address" {len=32  display=ipv4}
  }
}

compound_field "Record Routing"  {
  len = (valueof(field "Record Routing length")-1)*8
  field "Record Routing length" {len=8 }
  field "Record Routing pointer" {len=8 minValue=4}
  repeat {
    len = (valueof(field "Record Routing length")-3)*8
    field "source address" {len=32  display=ipv4}
  }
}
```

FIG. 8F

```
    compound_field "Stream ID" {
        len = 24
        field "Stream ID length" {
           len=8
                       default=4
                       possible_values={
                             0x04:"valid"
                    }}
      field "ID" {len=16 default=4}
    }

    compound_field "Internet Timestamp" {
      field "Internet Timestamp Length" {len=8 }
      field "Internet Timestamp Pointer" {len=8 }
      field "Overflow" {
                 len=4
        desc="number of IP modules that cannot register timestamps"
                 }
      field "Flag" {
                 len=4
                 possible_values={
        0:"time stamps only, stored in consecutive 32-bit words"
        1:"each timestamp is preceded with internet address"
        3:"the internet address fields are prespecified"
      }}

    } // end of Internet Timestamp
  } // end of field "option" ----------------------------------------


} // end of field "IP" ---------------------------------------------

field "Protocol" {

len=8
default=255
field_type = mulopt_prtcl_fld
display=hex
possible_values={ //---------------------------------------------
  0:"HOPOPT (IPv6 Hop-by-Hop Option)"
  1:"ICMP (Internet Control Message)"
  2:"IGMP (Internet Group Management)"
  3:"GGP (Gateway-to-Gateway)"
  4:"IP (IP in IP encapsulation)"
  5:"ST (Stream)"
  6:"TCP"
```

FIG. 8G

```
7:"CBT"
8:"EGP (Exterior Gateway Protocol)"
9:"IGP (any private interior gateway)"
10:"BBN-RCC-MON (BBN RCC Monitoring)"
11:"NVP-II (Network Voice Protocol)"
12:"PUP"
13:"ARGUS"
14:"EMCON"
15:"XNET (Cross Net Debugger)"
16:"CHAOS"
17:"UDP"
18:"MUX (Multiplexing)"
19:"DCN-MEAS (DCN Measurement Subsystems)"
20:"HMP (Host Monitoring)"
21:"PRM (Field Radio Measurement)"
22:"XNS-IDP (XEROX NS IDP)"
23:"TRUNK-1 (Trunk-1)"
24:"TRUNK-2 (Trunk-2)"
25:"LEAF-1 (Leaf-1)"
26:"LEAF-2 (Leaf-2)"
27:"RDP (Reliable Data Protocol)"
28:"IRTP (Internet Reliable Transaction)"
29:"ISO-TP4 (ISO Transport Protocol Class 4)"
30:"NETBLT (Bulk Data Transfer Protocol)"
31:"MFE-NSP (MFE Network Services Protocol)"
32:"MERIT-INP (MERIT Internodal Protocol)"
33:"SEP ( Sequential Exchange Protocol)"
34:"3PC (Third Party Connect Protocol)"
35:"IDPR (Inter-Domain Policy Routing Protocol)"
36:"XTP (XTP)"
37:"DDP (Datagram Delivery Protocol)"
38:"IDPR-CMTP (IDPR Control Message Transport Protocol)"
39:"TP++ (TP++ Transport Protocol)"
40:"IL (IL Transport Protocol)"
41:"IPv6 (Ipv6)"
42:"SDRP (Source Demand Routing Protocol)"
43:"IPv6-Route (Routing Header for IPv6)"
44:"IPv6-Frag (Fragment Header for IPv6)"
45:"IDRP (Inter-Domain Routing Protocol)"
46:"RSVP (Reservation Protocol)"
47:"GRE (General Routing Encapsulation)"
48:"MHRP (Mobile Host Routing Protocol)"
49:"BNA"
50:"ESP (Encap Security Payload for IPv6)"
51:"AH (Authentication Header for IPv6)"
52:"I-NLSP (Integrated Net Layer Security  TUBA)"
```

FIG. 8H

```
53:"SWIPE (IP with Encryption)"
54:"NARP (NBMA Address Resolution Protocol)"
55:"MOBILE (IP Mobility)"
56:"TLSP (Transport Layer Security Protocol)"
57:"SKIP"
58:" IPv6-ICMP (ICMP for IPv6)"
59:"IPv6-NoNxt (No Next Header for IPv6)"
60:"IPv6-Opts (Destination Options for IPv6)"
61:"AHP (any host internal protocol)"
62:"CFTP (CFTP)"
63:"ALN (any local network)"
64:"SAT-EXPAK (SATNET and Backroom EXPAK)"
65:"KRYPTOLAN (Kryptolan)"
66:"RVD (MIT Remote Virtual Disk Protocol)"
67:"IPPC (Internet Pluribus Field Core)"
68:"ADFS (any distributed file system)"
69:"SAT-MON (SATNET Monitoring)"
70:"VISA (VISA Protocol)"
71:"IPCV (Internet Field Core Utility)"
72:"CPNX (Computer Protocol Network Executive)"
73:"CPHB ( Computer Protocol Heart Beat)"
74:"WSN (Wang Span Network)"
75:"PVP (Field Video Protocol)"
76:"BR-SAT-MON (Backroom SATNET Monitoring)"
77:"SUN-ND (SUN ND PROTOCOL-Temporary)"
78:"WB-MON (WIDEBAND Monitoring)"
79:"WB-EXPAK ( WIDEBAND EXPAK )"
80:"ISO-IP (ISO Internet Protocol)"
81:"VMTP"
82:"SECURE-VMTP)"
83:"VINES"
84:"TTP"
85:"NSFNET-IGP"
86:"DGP (Dissimilar Gateway Protocol)"
87:"TCF"
88:"EIGRP"
89:"OSPF"
90:"Sprite-RPC (Sprite RPC Protocol)"
91:"LARP (Locus Address Resolution Protocol)"
92:"MTP (Multicast Transport Protocol)"
93:"AX.25 (AX.25 Frames)"
94:"IPIP (IP-within-IP Encapsulation Protocol)"
95:"MICP (Mobile Internetworking Control Pro)"
96:"SCC-SP (Semaphore Communications Sec. Pro)"
97:"ETHERIP (Ethernet-within-IP Encapsulation)"
98:"ENCAP (Encapsulation Header)"
```

FIG. 8I

```
    99:"APES (any private encryption scheme)"
    100:"GMTP"
    101:"IFMP (Ipsilon Flow Management Protocol)]"
    102:"PNNI (PNNI over IP)"
    103:"PIM (Protocol Independent Multicast)"
    104:"ARIS"
    105:"SCPS"
    106:"QNX"
    107:"A/N (Active Networks)"
    108:"IPPCP (IP Payload Compression Protocol)"
    109:"SNP (Sitara Networks Protocol)"
    110:"Compaq-Peer (Compaq Peer Protocol)"
    111:"IPX-in-IP"
    112:"VRRP (Virtual Router Redundancy Protocol)"
    113:"PGM (PGM Reliable Transport Protocol)"
    114:"AHOP (any 0-hop protocol)"
    115-254:"Unassigned"
    255:"Reserved"
  }} // end of field "protocol" ----------------------------------------

    } // end of field "IP header" ------------------------------------


836 payload "IP Payload" {//------------------------------------------
      switch(valueof(field "Protocol")) {
838         1:protocol   "ICMP"
      2:protocol   "IGMP"
      6:protocol   "TCP"
      17:protocol   "UDP"
      46:protocol   "RSVP"
      47:protocol   "GRE"
      89:protocol   "OSPF"
      }
    } // end of packet "IP payload" ----------------------------------
  }
```

FIG. 9A

```
*/
/**********************************************************************
Constants
**********************************************************************/
//============  LCP Options=========================================
int OPT_PASSIVE   = 1;  // Don't die if we don't get a response
int OPT_RESTART = 2;    // Treat 2nd OPEN as DOWN, UP
int OPT_SILENT = 4;         // Wait for peer to speak first


//============  LCP States ==========================================
int INITIAL_STATE = 0;
int STARTING_STATE = 1;
int CLOSED_STATE = 2;
int STOPPED_STATE = 3;
int CLOSING_STATE = 4;
int STOPPING_STATE = 5;
int REQ_SENT_STATE = 6;
int ACK_RCVD_STATE = 7;
int ACK_SENT_STATE = 8;
int OPENED_STATE = 9;


//============  LCP Events  ==========================================
int UP_EVENT = 0;
int DOWN_EVENT = 1;
int OPEN_EVENT = 2;
int CLOSE_EVENT = 3;
int TIMEOUT_POS_EVENT = 4;
int TIMEOUT_NEG_EVENT = 5;
int RCV_CFG_REQ_POS_EVENT = 6;
int RCV_CFG_REQ_NEG_EVENT = 7;
int RCV_CFG_ACK_EVENT = 8;
int RCV_CFG_NACK_EVENT = 9;
int RCV_TERM_REQ_EVENT = 10;
int RCV_TERM_ACK_EVENT = 11;
int RCV_UNKN_CODE_EVENT = 12;
int RCV_CODE_REJECT_POS_EVENT = 13;
int RCV_CODE_REJECT_NEG_EVENT = 14;
int RCV_ECHO_REQ_REPLY_EVENT = 15;


//============  Transition constants================================
int TRANSITON_CNST_FALSE = 0
int TRANSITON_CNST_TRUE = 1
```

```
902 ~ fsm  "LCP"                                          924
      {

904 ~ state  INITIAL_STATE
      {
926 ─ UP_EVENT    -                  CLOSED_STATE
928 ─ OPEN_EVENT InitialStOpenEvent   STARTING_STATE
      } // INITIAL
```

FIG. 9B

```
906~state STARTING_STATE
    {

    UP_EVENT
    \
            switch(enabledSilent())
    \
            {
    \
                TRANSITON_CNST_TRUE:    StartingStUpEvEnabledSilentTRUE
    STOPPED_STATE    \
                TRANSITON_CNST_FALSE:   StartingStUpEvEnabledSilentFALSE
    REQ_SENT_STATE   \
            }
    \
    CLOSE_EVENT          -
    INITIAL_STATE

    } // STARTING

908~state CLOSED_STATE
    {
    DOWN_EVENT                  -                                   INITIAL_STATE
    OPEN_EVENT
    \
        switch(enabledSilent())
    \
        {
    \
            TRANSITON_CNST_TRUE:    ClosedStOpenEvEnabledSilentTRUE
    STOPPED_STATE    \
            TRANSITON_CNST_FALSE:   ClosedStOpenEvEnabledSilentFALSE
    REQ_SENT_STATE   \
        }
    \
    RCV_CFG_REQ_POS_EVENT       ClosedStRcvCfgReqPosEv              CLOSED_STATE
    RCV_CFG_REQ_NEG_EVENT       ClosedStRcvCfgReqNegEv              CLOSED_STATE
    RCV_CFG_ACK_EVENT           ClosedStRcvCfgAckEv                 CLOSED_STATE
    RCV_CFG_NACK_EVENT          ClosedStRcvCfgNackEv                CLOSED_STATE
    RCV_CODE_REJECT_POS_EVENT   RcvCodeRejectPosEv                  CLOSED_STATE
    RCV_CODE_REJECT_NEG_EVENT   ClosedStRcvCodeRejectNegEv          CLOSED_STATE
    RCV_ECHO_REQ_REPLY_EVENT    RcvEchoReqReplyEv                   CLOSED_STATE

    } // CLOSED

910~state STOPPED_STATE
    {
    DOWN_EVENT                  StoppedStDownEv                     STARTING_STATE
    OPEN_EVENT
    \
        switch(enabledRestart())
    \
        {
    \
          TRANSITON_CNST_TRUE:  StoppedStOpenEvEnabledRestartTRUE   STOPPED_STATE
    \
```

FIG. 9C

```
     }
  \
  CLOSE_EVENT                  -                                   CLOSED_STATE
  RCV_CFG_REQ_POS_EVENT        StoppedStRcvCfgReqPosEv             ACK_SENT_STATE
  RCV_CFG_REQ_NEG_EVENT        StoppedStRcvCfgReqNegEv             REQ_SENT_STATE
  RCV_CFG_ACK_EVENT            StoppedStRcvCfgAckEv                STOPPED_STATE
  RCV_CFG_NACK_EVENT           StoppedStRcvCfgNackEv               STOPPED_STATE
  RCV_CODE_REJECT_POS_EVENT    RcvCodeRejectPosEv                  STOPPED_STATE
  RCV_CODE_REJECT_NEG_EVENT    StoppedStRcvCodeRejectNegEv         STOPPED_STATE
  RCV_ECHO_REQ_REPLY_EVENT     RcvEchoReqReplyEv                   STOPPED_STATE

  } // STOPPED

912~state CLOSING_STATE
  {
  DOWN_EVENT                   ClosingStDownEv                INITIAL_STATE
  OPEN_EVENT                   ClosingStOpenEv                STOPPING_STATE
  TIMEOUT_POS_EVENT            ClosingStTimeoutPosEv          CLOSING_STATE
  TIMEOUT_NEG_EVENT            ClosingStTimeNegEv             CLOSED_STATE
  RCV_TERM_ACK_EVENT           ClosingStRcvTermAckEv          CLOSED_STATE
  RCV_CODE_REJECT_POS_EVENT    RcvCodeRejectPosEv             CLOSING_STATE
  RCV_CODE_REJECT_NEG_EVENT    RcvCodeRejectNegEv             CLOSED_STATE
  RCV_ECHO_REQ_REPLY_EVENT     RcvEchoReqReplyEv              CLOSING_STATE

  } // CLOSING

914~state STOPPING_STATE
  {
  DOWN_EVENT                   StoppingStDownEv               STARTING_STATE
  CLOSE_EVENT                  -                              CLOSING_STATE
  TIMEOUT_POS_EVENT            StoppingStTimeoutPosEv         STOPPING_STATE
  TIMEOUT_NEG_EVENT            StoppingStTimeNegEv            STOPPED_STATE
  RCV_TERM_ACK_EVENT           StoppingStRcvTermAckEv         STOPPED_STATE
  RCV_CODE_REJECT_POS_EVENT    RcvCodeRejectPosEv             STOPPING_STATE
  RCV_CODE_REJECT_NEG_EVENT    RcvCodeRejectNegEv             STOPPED_STATE
  RCV_ECHO_REQ_REPLY_EVENT     RcvEchoReqReplyEv              STOPPING_STATE

  } // STOPPING

916~state REQ_SENT_STATE
  {
  DOWN_EVENT                   ReqSentStDownEv            STARTING_STATE
  CLOSE_EVENT                  ReqSentStCloseEv           CLOSING_STATE
  TIMEOUT_POS_EVENT            ReqSentStTimeoutPosEv      REQ_SENT_STATE
  TIMEOUT_NEG_EVENT            ReqSentStTimeNegEv         STOPPED_STATE
  RCV_CFG_REQ_POS_EVENT        ReqSentStRcvCfgReqPosEv    ACK_SENT_STATE
  RCV_CFG_REQ_NEG_EVENT        ReqSentStRcvCfgReqNegEv    REQ_SENT_STATE
  RCV_CFG_ACK_EVENT            ReqSentStRcvCfgAckEv       ACK_RCVD_STATE
  RCV_CFG_NACK_EVENT           ReqSentStRcvCfgNackEv      REQ_SENT_STATE
  RCV_CODE_REJECT_POS_EVENT    RcvCodeRejectPosEv         REQ_SENT_STATE
  RCV_CODE_REJECT_NEG_EVENT    RcvCodeRejectNegEv         STOPPED_STATE
  RCV_ECHO_REQ_REPLY_EVENT     RcvEchoReqReplyEv          REQ_SENT_STATE

  } // REQ_SENT_STATE

918~state ACK_RCVD_STATE
```

FIG. 9D

```
{
DOWN_EVENT                    AckRcvdStDownEv             STARTING_STATE
CLOSE_EVENT                   AckRcvdStCloseEv            CLOSING_STATE
TIMEOUT_POS_EVENT             AckRcvdStTimeoutPosEv       REQ_SENT_STATE
TIMEOUT_NEG_EVENT             AckRcvdStTimeNegEv          STOPPED_STATE
RCV_CFG_REQ_POS_EVENT         AckRcvdStRcvCfgReqPosEv     OPENED_STATE
RCV_CFG_REQ_NEG_EVENT         AckRcvdStRcvCfgReqNegEv     ACK_RCVD_STATE
RCV_CFG_ACK_EVENT             AckRcvdStRcvCfgAckEv        REQ_SENT_STATE
RCV_CFG_NACK_EVENT            AckRcvdStRcvCfgNackEv       REQ_SENT_STATE
RCV_TERM_REQ_EVENT            AckRcvdStRcvTermReqEv       REQ_SENT_STATE
RCV_TERM_ACK_EVENT            -                           REQ_SENT_STATE
RCV_UNKN_CODE_EVENT           -                           ACK_RCVD_STATE
RCV_CODE_REJECT_POS_EVENT     RcvCodeRejectPosEv          REQ_SENT_STATE
RCV_CODE_REJECT_NEG_EVENT     RcvCodeRejectNegEv          STOPPED_STATE
RCV_ECHO_REQ_REPLY_EVENT      RcvEchoReqReplyEv           ACK_RCVD_STATE

} // ACK_RCVD_STATE


920~state ACK_SENT_STATE
{
DOWN_EVENT                    AckSentStDownEv             STARTING_STATE
CLOSE_EVENT                   AckSentStCloseEv            CLOSING_STATE
TIMEOUT_POS_EVENT             AckSentStTimeoutPosEv       ACK_SENT_STATE
TIMEOUT_NEG_EVENT             AckSentStTimeNegEv          STOPPED_STATE
RCV_CFG_REQ_POS_EVENT         AckSentStRcvCfgReqPosEv     ACK_SENT_STATE
RCV_CFG_REQ_NEG_EVENT         AckSentStRcvCfgReqNegEv     REQ_SENT_STATE
RCV_CFG_ACK_EVENT             AckSentStRcvCfgAckEv        OPENED_STATE
RCV_CFG_NACK_EVENT            AckSentStRcvCfgNackEv       ACK_SENT_STATE
RCV_TERM_REQ_EVENT            AckSentStRcvTermReqEv       REQ_SENT_STATE
RCV_CODE_REJECT_POS_EVENT     RcvCodeRejectPosEv          ACK_SENT_STATE
RCV_CODE_REJECT_NEG_EVENT     RcvCodeRejectNegEv          STOPPED_STATE
RCV_ECHO_REQ_REPLY_EVENT      RcvEchoReqReplyEv           ACK_SENT_STATE

} // ACK_SENT_STATE


922 state OPENED_STATE
{
DOWN_EVENT                    OpenedStDownEv                           STARTING_STATE
OPEN_EVENT
\
    switch(enabledRestart())
\
    {
\
     TRANSITON_CNST_TRUE:     OpenedStOpenEvEnabledRestartTRUE         OPENED_STATE
\
    }
\
CLOSE_EVENT                   OpenedStCloseEv                          CLOSING_STATE
RCV_CFG_REQ_POS_EVENT         OpenedStRcvCfgReqPosEv                   ACK_SENT_STATE
RCV_CFG_REQ_NEG_EVENT         OpenedStRcvCfgReqNegEv                   REQ_SENT_STATE
RCV_CFG_ACK_EVENT             OpenedStRcvCfgAckEv                      REQ_SENT_STATE
RCV_CFG_NACK_EVENT            OpenedStRcvCfgNackEv                     REQ_SENT_STATE
RCV_TERM_REQ_EVENT            OpenedStRcvTermReqEv                     STOPPING_STATE
RCV_TERM_ACK_EVENT            OpenedStRcvTermAckEv                     REQ_SENT_STATE
```

FIG. 9E

```
RCV_CODE_REJECT_POS_EVENT    RcvCodeRejectPosEv                  OPENED_STATE
RCV_CODE_REJECT_NEG_EVENT    OpenedStRcvCodeRejectNegEv          STOPPING_STATE
RCV_ECHO_REQ_REPLY_EVENT     RcvEchoReqReplyEv                   OPENED_STATE

} // OPENED_STATE


}
```

FIG. 10

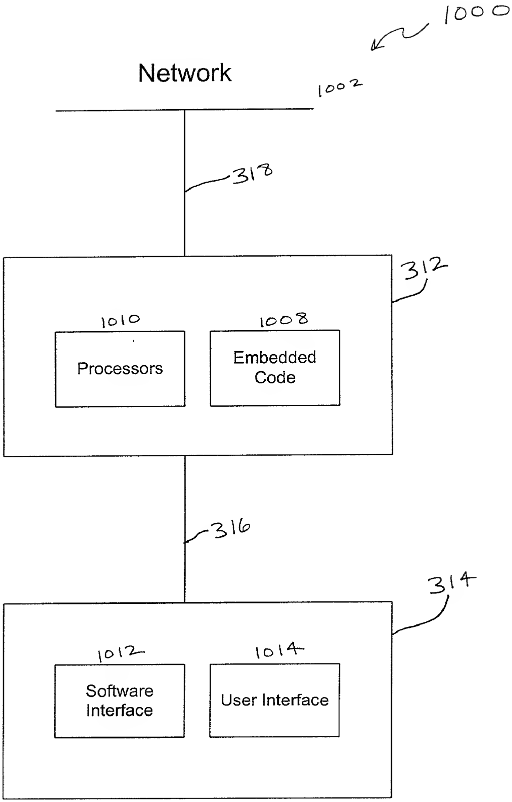

1000
Network
1002
318
312
1010
Processors
1008
Embedded Code
316
314
1012
Software Interface
1014
User Interface

FIG. 11

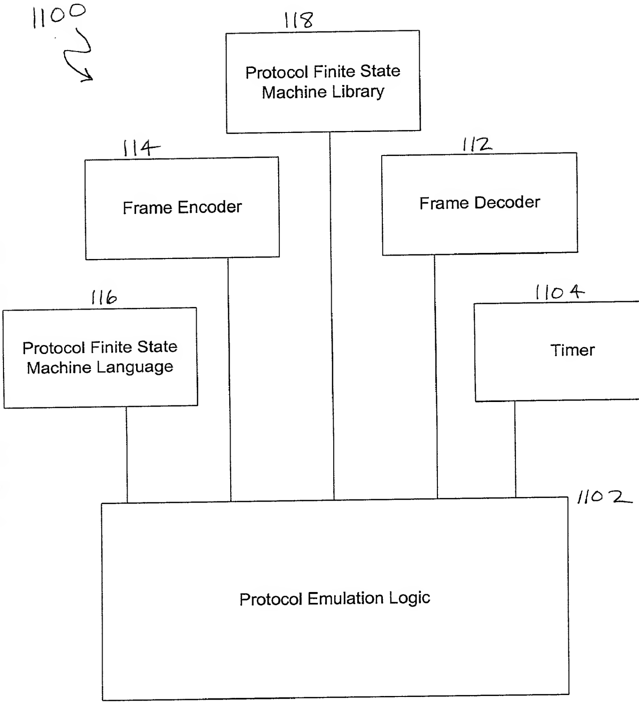

1100
118
Protocol Finite State Machine Library
114
Frame Encoder
112
Frame Decoder
116
Protocol Finite State Machine Language
1104
Timer
1102
Protocol Emulation Logic

FIG. 12A

1202

Events	State 0 Initial	1 Starting	2 Closed	3 Stopped	4 Closing	5 Stopping
Up	2	tc1,6	–	–	–	–
Down	–	–	0	1	0	1
Open	1	1	tc1,3/tc2,6	tc3,3r	5r	5r
Close	0	0	2	2	4	4
TO+	–	–	–	–	4	5
TO-	–	–	–	–	2	3
RCR+	–	–	2	8	4	5
RCR-	–	–	2	6	4	5
RCA	–	–	2	3	4	5
RCN	–	–	2	3	4	5
RTR	–	–	2	3	4	5
RTA	–	–	2	3	2	3
RUC	–	–	2	3	4	5
RXJ+	–	–	2	3	4	5
RXJ-	–	–	2	3	2	3
RXR	–	–	2	3	4	5

FIG. 12B

1204

Events	State 6 Req-Sent	7 Ack-Rcvd	8 Ack-Sent	9 Opened
Up	-	-	-	-
Down	1	1	1	1
Open	6	7	8	tc3,9r
Close	4	4	4	4
TO+	6	6	8	-
TO-	3p	3p	3p	-
RCR+	8	9	8	8
RCR-	6	7	6	6
RCA	7	6	9	6
RCN	6	6	8	6
RTR	6	6	6	5
RTA	6	6	8	6
RUC	6	7	8	9
RXJ+	6	6	8	9
RXJ-	3	3	3	5
RXR	6	7	8	9

```
[p]   Passive option
[r]   Restart option
[s]   Silent option

// Transition conditions
tc1 -  (enabledSilent() == TRUE)
tc2 -  (enabledSilent() == FALSE)
tc3 -  (enabledRestart() == TRUE)
```

FIG. 13

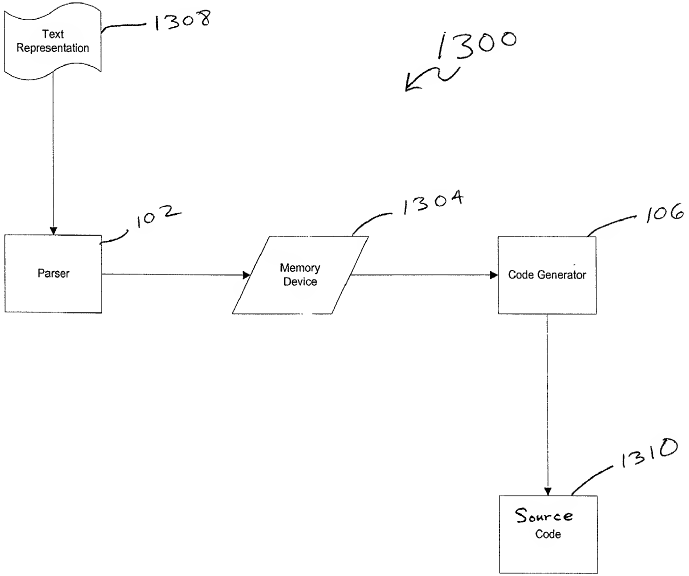
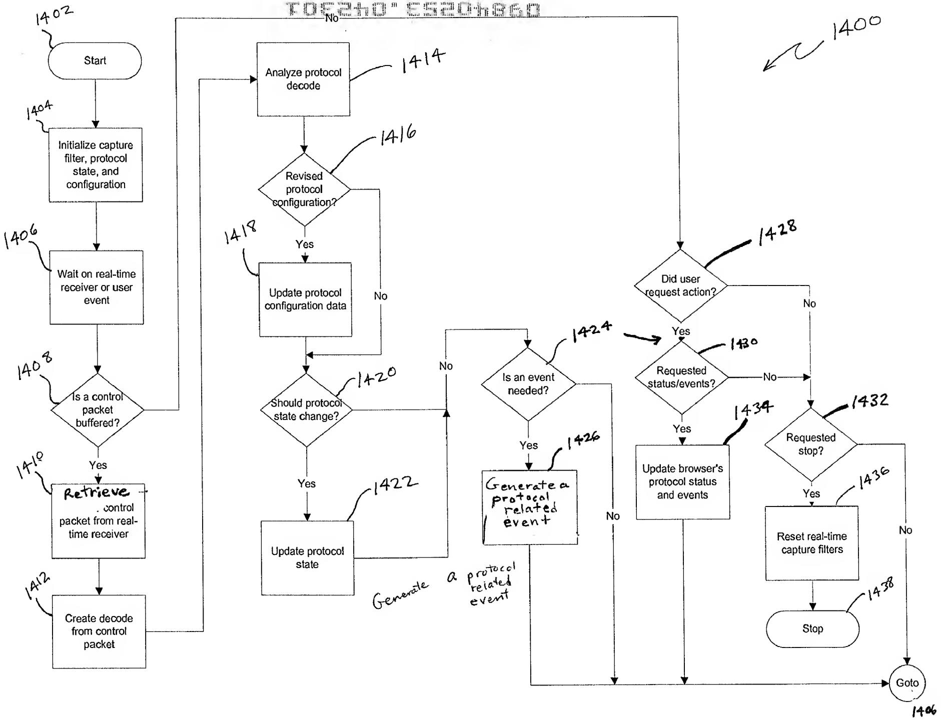

Text Representation
1308
1300
Parser
102
Memory Device
1304
Code Generator
106
Source Code
1310

FIG. 14



1400
1402
Start
1404
Initialize capture filter, protocol state, and configuration
1406
Wait on real-time receiver or user event
1408
Is a control packet buffered?
No
Yes
1410
Retrieve . control packet from real-time receiver
1412
Create decode from control packet
1414
Analyze protocol decode
1416
Revised protocol configuration?
Yes
No
1418
Update protocol configuration data
1420
Should protocol state change?
Yes
No
1422
Update protocol state
Generate a protocol related event
1424
Is an event needed?
Yes
No
1426
Generate a protocol related event
1428
Did user request action?
Yes
No
1430
Requested status/events?
Yes
No
1434
Update browser's protocol status and events
1432
Requested stop?
Yes
No
1436
Reset real-time capture filters
1438
Stop
Goto
1406

FIG. 15

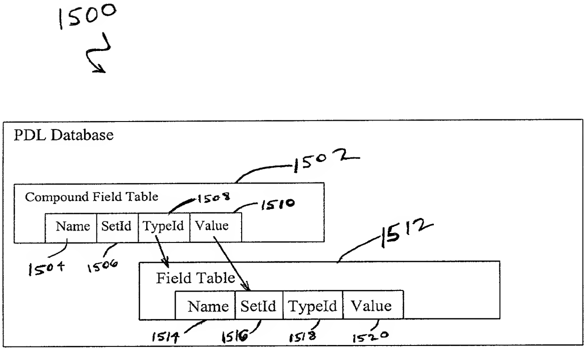

1500
PDL Database
1502
Compound Field Table
1508
1510
Name
SetId
TypeId
Value
1504
1506
1512
Field Table
Name
SetId
TypeId
Value
1514
1516
1518
1520

FIG. 16

1602 1604 1606 1608 1600

1610

TypeId	TypeName	TableName	Type	Comment
0	Start		Control	
0	ProtocolNames	ProtocolNames		
1	Protocol	Protocol	Compound	
2	Header	Header	Compound	
3	Payload	Payload	Compound	
4	Trailer	Trailer	Compound	
5	CompoundField	CompoundField	Compound	
6	Repeat	Repeat	Compound	
7	Switch	Switch	Compound	
8	PossibleValues	PossibleValues	Attribute	
9	Field	Field	Simple	
10	Len	Len	Attribute	
11	MinLen	Len	Attribute	
12	MaxLen	Len	Attribute	
13	Display	Display	Attribute	
14	Encode	Encode	Attribute	
15	Default	Default	Attribute	
16	Break	Len	Attribute	
17	Optional	Len	Attribute	
18	Offset	Len	Attribute	
19	Name	Name	Attribute	
20	Description	Description	Attribute	
21	String	String		
22	End	End	Control	
23	DecisiveField	Field	Simple	
24	FieldType	Attribute	Attribute	
28	MinVal	Attribute	Attribute	
29	MaxVal	Attribute	Attribute	
30	Count	Len	Attribute	

1612

FIG. 17

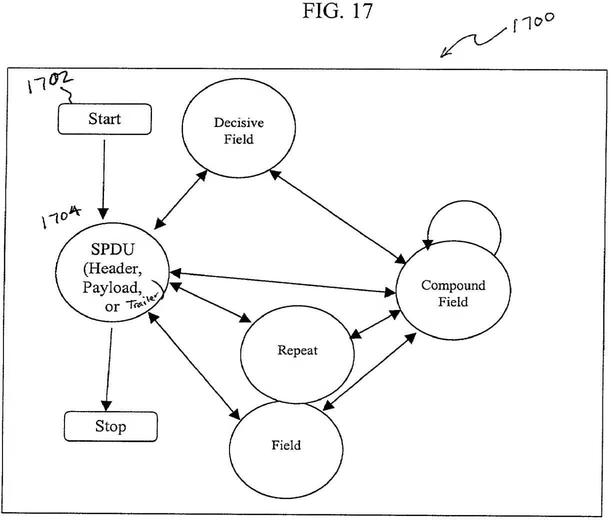
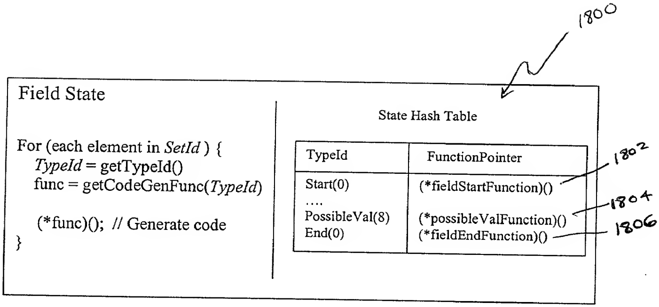

1700
1702
Start
Decisive Field
1704
SPDU (Header, Payload, or Trailer)
Compound Field
Repeat
Stop
Field

FIG. 18



Field State

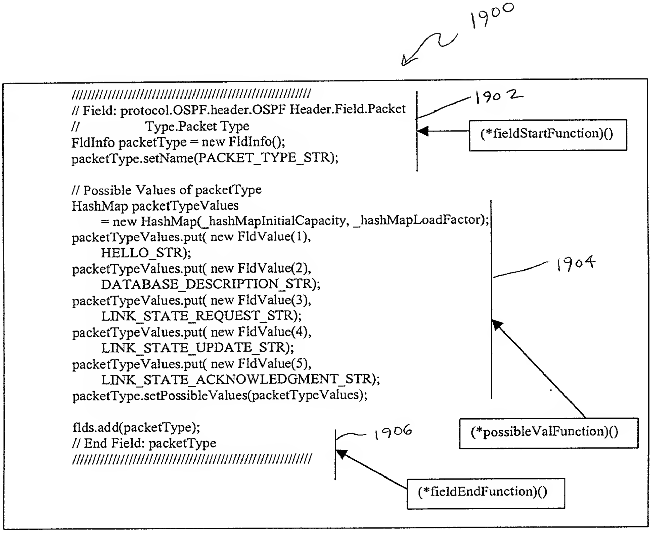
```
For (each element in SetId ) {
   TypeId = getTypeId()
   func = getCodeGenFunc(TypeId)

    (*func)();  // Generate code
}
```

State Hash Table

TypeId	FunctionPointer
Start(0)	(*fieldStartFunction)()
....	
PossibleVal(8)	(*possibleValFunction)()
End(0)	(*fieldEndFunction)()

FIG. 19



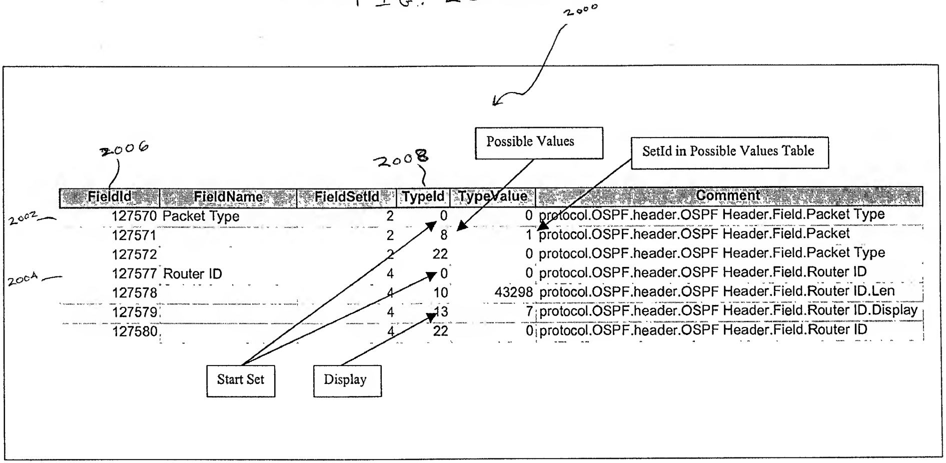
```
////////////////////////////////////////////////////////////////
// Field: protocol.OSPF.header.OSPF Header.Field.Packet
//              Type.Packet Type
FldInfo packetType = new FldInfo();
packetType.setName(PACKET_TYPE_STR);

// Possible Values of packetType
HashMap packetTypeValues
      = new HashMap(_hashMapInitialCapacity, _hashMapLoadFactor);
packetTypeValues.put( new FldValue(1),
      HELLO_STR);
packetTypeValues.put( new FldValue(2),
      DATABASE_DESCRIPTION_STR);
packetTypeValues.put( new FldValue(3),
      LINK_STATE_REQUEST_STR);
packetTypeValues.put( new FldValue(4),
      LINK_STATE_UPDATE_STR);
packetTypeValues.put( new FldValue(5),
      LINK_STATE_ACKNOWLEDGMENT_STR);
packetType.setPossibleValues(packetTypeValues);

flds.add(packetType);
// End Field: packetType
////////////////////////////////////////////////////////////////
```

TOE2H0"ES204860

FIG. 20



FieldId	FieldName	FieldSetId	TypeId	TypeValue	Comment
127570	Packet Type	2	0	0	protocol.OSPF.header.OSPF Header.Field.Packet Type
127571		2	8	1	protocol.OSPF.header.OSPF Header.Field.Packet
127572		2	22	0	protocol.OSPF.header.OSPF Header.Field.Packet Type
127577	Router ID	4	0	0	protocol.OSPF.header.OSPF Header.Field.Router ID
127578		4	10	43298	protocol.OSPF.header.OSPF Header.Field.Router ID.Len
127579		4	13	7	protocol.OSPF.header.OSPF Header.Field.Router ID.Display
127580		4	22	0	protocol.OSPF.header.OSPF Header.Field.Router ID

FIG. 21

Protocol	Status	Time	Mode
LCP	Open	09/04/00 08:01:03 AM	Emulate
IPCP	Negotiating	09/04/00 08:01:07 AM	Monitor
MPLSCP	Closed	09/04/00 08:01:05 AM	Monitor
RSVP	N/a	09/04/00 08:01:00 AM	Disabled

FIG. 22

	Rx1	Rx2
Current Status	Open	Negotiating
Loop-back	No	No
Unanswered Echo Requests	0	0
Maximum Receive Unit	512	1500
Asynchronous Character Map	0	0
Authentication Protocol	Unknown	Unknown
Quality Protocol	N/a	N/a
Protocol Field Compression	Off	Off
Address/Control Field Compression	Off	Off
Magic Number	0xFF	0x1FF
FCS Alternative	CCITT 32-bit	CCITT 32-bit

FIG. 23

Time	Recvr	Protocol	MsgType	Event	Synopsis
09/04/00 08:01:01 AM	Rx1	LCP	ConfigReq	Protocol Negotiating	ACComp:On,Pcomp:On,Magic:0x1ab82049
09/04/00 08:01:01 AM	Rx2	LCP	ConfigAck	Open Protocol	ACComp:On,Pcomp:On,Magic:0x4e3d9123
09/04/00 08:01:02 AM	Rx2	LCP	ConfigReq	Protocol Negotiating	ACComp:On,Pcomp:On,Magic:0x1ab82049
09/04/00 08:01:03 AM	Rx1	LCP	ConfigAck	Open Protocol	ACComp:On,Pcomp:On,Magic:0x1ab82049
09/04/00 08:01:04 AM	Rx2	IPCP	ConfigReq	Protocol Negotiating	Local IP: 198.85.38.199
09/04/00 08:01:06 AM	Rx1	IPCP	ConfigAck	Open Protocol	Local IP: 198.85.38.199
09/04/00 08:01:06 AM	Rx1	IPCP	ConfigReq	Protocol Negotiating	Local IP: 198.85. 34.45
09/04/00 08:01:06 AM	Rx2	IPCP	ConfigAck	Open Protocol	Local IP: 198.85. 34.45
09/04/00 08:01:10 AM	Rx2	MPLSCP	ConfigReq	Protocol Negotiating	
09/04/00 08:01:12 AM	Rx2	MPLSCP	TermReq	Close Protocol	
09/04/00 08:11:01 AM	Rx1	RSVP	Rx1	Rx1	Resv Request <session: 198.85.34.45 UDP port 14>
09/04/00 08:11:03 AM	Rx1	RSVP	Rx1	Rx1	Resv Confirm <session: 198.85.34.45 UDP port 14>
09/04/00 08:11:04 AM	Rx2	RSVP	Rx2	Rx2	Path Requcst <session: 198.85.38.199 UDP port 0x82A>
09/04/00 08:11:06 AM	Rx1	RSVP	Rx1	Rx1	Resv Error <session: 198.85. 38.199 UDP port 0x82A>
09/04/00 09:21:10 AM	Rx2	RSVP	Rx2	Rx2	Path Request <session: 198.85. 38.199 UDP port 0x82A>
09/04/00 09:21:12 AM	Rx2	RSVP	Rx2	Rx2	Rcsv Confirm <session: 198.85. 38.199 UDP port 0x82A>
09/04/00 09:21:30 AM	Rx1	RSVP	Rx1	Rx1	Path Tear <session: 198.85.34.45 UDP port 14>
09/04/00 09:21:32 AM	Rx2	RSVP	Rx2	Rx2	Resv Tear <session: 198.85.34.45 UDP port 14>
09/04/00 09:21:32 AM	Rx2	RSVP	Rx2	Rx2	Resv Tear <session: 198.85.34.45 UDP port 14>
09/04/00 11:44:30 PM	Rx1	IPCP	TermReq	Close Protocol	
09/04/00 11:44:31 PM	Rx1	IPCP	TermAck	Close Protocol	
09/04/00 11:44:32 PM	Rx1	LCP	TermReq	Close Protocol	
09/04/00 11:44:33 PM	Rx2	LCP	TermAck	Close Protocol	